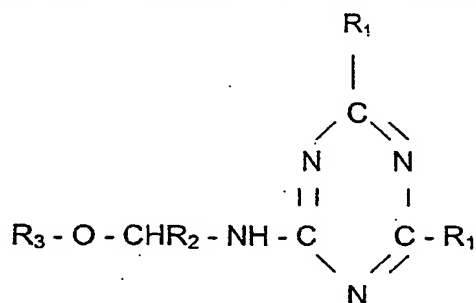


## Patent claims

1. A prepreg for fiber composites having high strength and resilience, characterized in that the prepreg comprises from 50 to 85% by mass of sheet-like textile structures and from 15 to 50% by mass of polyaminotriazine ethers containing carbamic ester groups and based on

A) aminotriazine ethers of the structure



$R_1 =$   $-NH_2$ ,  $-NH-CHR_2-OH$ ,  $-NH-CHR_2-O-R_3$ ,  
 $-NH-CHR_2-O-R_4-OH$ ,  $-CH_3$ ,  $-C_3H_7$ ,  $-C_6H_5$ ,  $-OH$ ,  
 phthalimido, succinimido-,  $-NH-CO-C_5-C_{18}\text{-alkyl}$ ,  
 $-NH-C_5-C_{18}\text{-alkylene-OH}$ ,  
 $-NH-CHR_2-O-C_5-C_{18}\text{-alkylene-NH}_2$ ,  
 $-NH-C_5-C_{18}\text{-alkylene-NH}_2$ ,

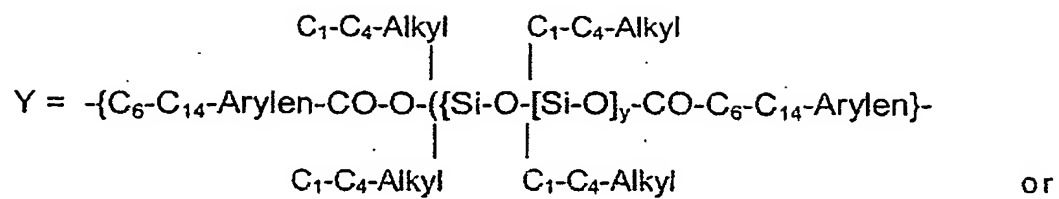
$R_2 = -H$ ,  $-C_1-C_7\text{-alkyl}$ ;

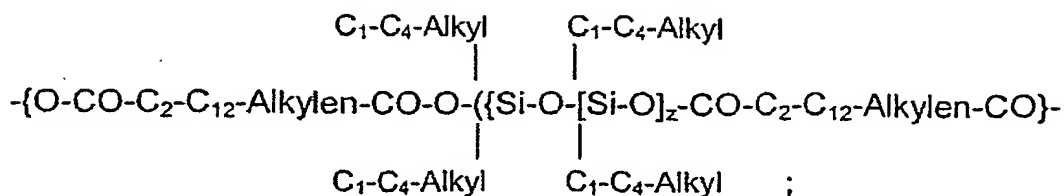
$R_3 = -C_1-C_{18}\text{-alkyl}$ ,  $-R_4-OH$ ,

$R_4 = -CH(CH_3)-CH_2-O-C_2-C_{12}\text{-alkylene-O-CH}_2-CH(CH_3)-$ ,  
 $-CH(CH_3)-CH_2-O-C_2-C_{12}\text{-arylene-O-CH}_2-CH(CH_3)-$ ,  
 $-[CH_2-CH_2-O-CH_2-CH_2]_n-$ ,  
 $-[CH_2-CH(CH_3)-O-CH_2-CH(CH_3)]_n-$ ,  
 $-[O-CH_2-CH_2-CH_2-CH_2]_n-$ ,  
 $-[(CH_2)_{2-8}-O-CO-C_6-C_{14}\text{-arylene-CO-O-(CH}_2)_{2-8}]_n-$ ,  
 $-[(CH_2)_{2-8}-O-CO-C_2-C_{12}\text{-alkylene-CO-O-(CH}_2)_{2-8}]_n-$ ,  
 where  $n = 1$  to  $200$ ;

- polyester sequences containing siloxane groups  
 of the type  $-[(X)_r-O-CO-(Y)_s-CO-O(X)_r]-$ , in  
 which

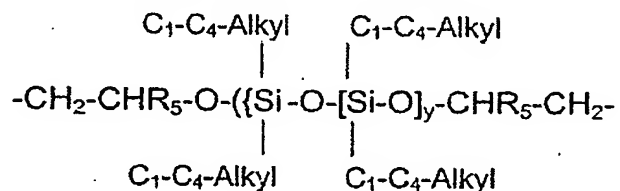
$X = \{(CH_2)_{2-8}-O-CO-C_6-C_{14}\text{-arylene-CO-O-(CH}_2)_{2-8}\}-$  or  
 $\{(CH_2)_{2-8}-O-CO-C_2-C_{12}\text{-alkylene-CO-O-(CH}_2)_{2-8}\}-$ ;





$r = 1$  to  $70$ ;  $s = 1$  to  $70$  and  $y = 3$  to  $50$ ;

- 5        - polyether sequences which contain siloxane groups and are of the type



where  $R_5 = \text{H}$ ;  $\text{C}_1\text{-C}_4\text{-alkyl}$  and  $y = 3$  to  $50$ ;

- 10        - sequences based on alkylene oxide adducts of melamine of the type comprising 2-amino-4,6-di-  
 $\text{C}_2\text{-C}_4\text{-alkyleneamino-1,3,5-triazine}$  sequences;

- 15        - phenol ether sequences based on dihydric phenols and  $\text{C}_2\text{-C}_8\text{-diols}$  of the type comprising  
 $\text{-C}_2\text{-C}_8\text{-alkylene-O-C}_6\text{-C}_{18}\text{-arylene-O-C}_2\text{-C}_8\text{-alkylene}$  sequences;

and/or

- 20        B) mixtures of from 10 to 90% by mass of aminotriazine ethers A) and from 90 to 10% by mass of polyaminotriazine ethers having molar masses of from 300 to 5000, the polyaminotriazine ethers being formed by thermal autocondensation of  
 25        aminotriazine ethers A),

and

- 30        C) isocyanates of the formula  $R_6(\text{N}=\text{C}=\text{O})_2$ ,  
 where  $R_6 = \text{C}_6\text{-C}_{14}\text{-arylene}$ ,  $\text{C}_4\text{-C}_{18}\text{-alkylene}$  and/or  $\text{C}_5\text{-C}_8\text{-cycloalkylene}$ , and/or oligomeric polyesters or polyethers having terminal isocyanate groups and

molar masses of from 200 to 5000,

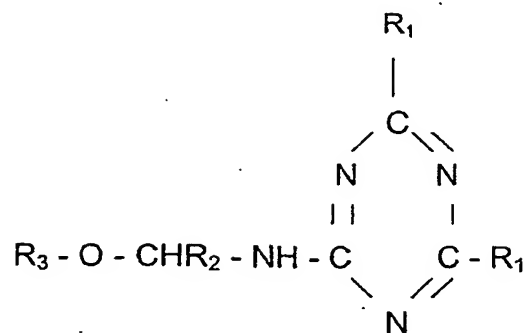
the molar ratio of triazine segment to carbamic ester groups being from 1 : 1 to 1 : 4.

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2. The prepreg as claimed in claim 1, characterized in that the textile substrate materials are woven fabrics or nonwovens, preferably woven fabrics or nonwovens comprising glass fibers, carbon fibers, polyamide fibers, polyester fibers, polypropylene fibers and/or thermosetting plastic fibers.
- 10

3. The prepreg as claimed in claim 1 or 2, characterized in that the ratio of aldehyde component to triazine component is from 1 : 1 to 3 : 1 in the polyaminotriazine ethers containing carbamic ester groups.
4. The prepreg as claimed in at least one of the preceding claims, characterized in that the polyaminotriazine ethers containing carbamic ester groups are polyaminotriazine ethers based on melamine, formaldehyde, methanol and diisocyanates of the type  $R_6(N = C = O)_2$ .
5. The prepreg as claimed in at least one of the preceding claims, characterized in that the polyaminotriazine ethers containing carbamic ester groups are polyaminotriazine ethers based on
- B) mixtures of from 5 to 30% by mass of aminotriazine ethers A) and from 95 to 70% by mass of polyaminotriazine ethers having molar masses of from 300 to 5000, the polyaminotriazine ethers being formed by thermal autocondensation of aminotriazine ethers A), and
- C) isocyanates of the formula  $R_6(N = C = O)_2$ , where  $R_4 = C_4-C_{18}$ -alkylene and/or  $C_5-C_8$ -cycloalkylene, and/or oligomeric polyesters or polyethers having terminal isocyanate groups and molar masses of from 200 to 5000.
6. A process for the production of prepregs for fiber composites having high strength and resilience, characterized in that prepregs which comprise from 50 to 85% by mass of sheet-like textile structures and from 15 to 50% by mass of polyaminotriazine ethers containing carbamic ester groups are produced by a melt application method in which mixtures of

A) aminotriazine ethers of the structure



$R_1 = -NH_2, -NH-CHR_2-OH, -NH-CHR_2-O-R_3,$   
 $-NH-CHR_2-O-R_4-OH, -CH_3, -C_3H_7, -C_6H_5, -OH,$   
 phthalimido, succinimido-,  $-NH-CO-C_5-C_{18}-alkyl,$   
 $-NH-C_5-C_{18}-alkylene-OH,$   
 5  $-NH-CHR_2-O-C_5-C_{18}-alkylene-NH_2,$   
 $-NH-C_5-C_{18}-alkylene-NH_2,$

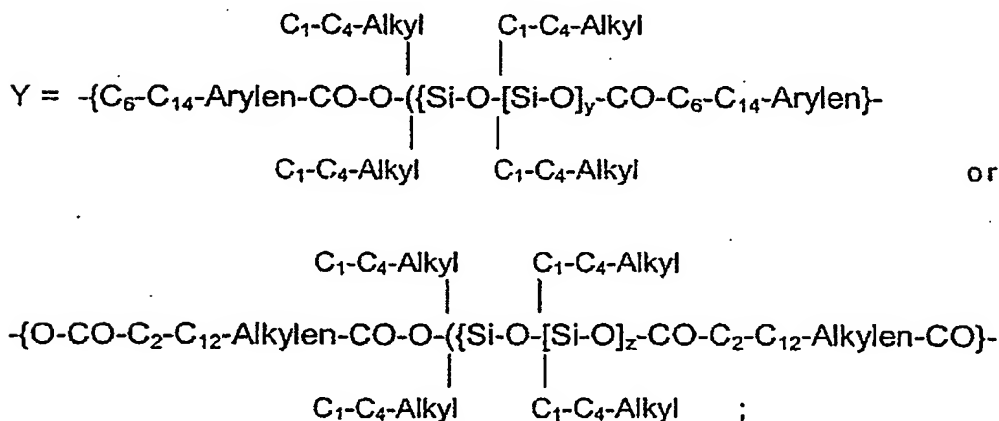
$R_2 = -H, -C_1-C_7-alkyl;$

$R_3 = -C_1-C_{18}-alkyl, -R_4-OH,$

10  $R_4 = -CH(CH_3)-CH_2-O-C_2-C_{12}-alkylene-O-CH_2-CH(CH_3)-,$   
 $-CH(CH_3)-CH_2-O-C_2-C_{12}-arylene-O-CH_2-CH(CH_3)-,$   
 $-[CH_2-CH_2-O-CH_2-CH_2]_n-,$   
 $-[CH_2-CH(CH_3)-O-CH_2-CH(CH_3)]_n-,$   
 15  $-[O-CH_2-CH_2-CH_2-CH_2]_n-,$   
 $-[(CH_2)_{2-8}-O-CO-C_6-C_{14}-arylene-CO-O-(CH_2)_{2-8}]_n-,$   
 $-[(CH_2)_{2-8}-O-CO-C_2-C_{12}-alkylene-CO-O-(CH_2)_{2-8}]_n-,$   
 where  $n = 1$  to  $200;$

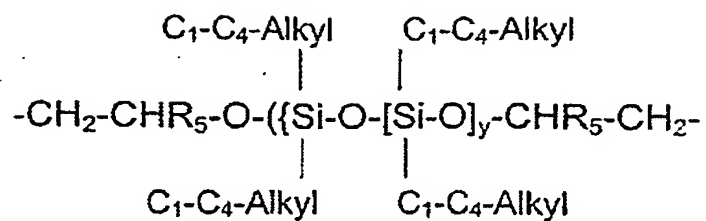
- polyester sequences containing siloxane groups  
 20 of the type  $-(X)_r-O-CO-(Y)_s-CO-O(X)_r-$ , in  
 which

$X = \{(CH_2)_{2-8}-O-CO-C_6-C_{14}-arylene-CO-O-(CH_2)_{2-8}\}-$  or  
 $\{(CH_2)_{2-8}-O-CO-C_2-C_{12}-alkylene-CO-O-(CH_2)_{2-8}\}-;$



25  $r = 1$  to  $70;$   $s = 1$  to  $70$  and  $y = 3$  to  $50;$

- polyether sequences containing siloxane groups  
 of the type



where  $R_5 = \text{H}$ ;  $\text{C}_1\text{-C}_4\text{-alkyl}$  and  $y = 3$  to  $50$ ;

- 5        - sequences based on alkylene oxide adducts of melamine of the type comprising 2-amino-4,6-di-  
 $\text{C}_2\text{-C}_4\text{-alkyleneamino-1,3,5-triazine}$  sequences:



- phenol ether sequences based on dihydric phenols and C<sub>2</sub>-C<sub>8</sub>-diols of the type comprising -C<sub>2</sub>-C<sub>8</sub>-alkylene-O-C<sub>6</sub>-C<sub>18</sub>-arylene-O-C<sub>2</sub>-C<sub>8</sub>-alkylene sequences;

and/or

B) mixtures of from 10 to 90% by mass of aminotriazine ethers A) and from 90 to 10% by mass of polyaminotriazine ethers having molar masses of from 300 to 5000, the polyaminotriazine ethers being formed by thermal autocondensation of aminotriazine ethers A),

and

C) isocyanates of the formula R<sub>6</sub>(N = C = O)<sub>2</sub>, where R<sub>6</sub> = C<sub>6</sub>-C<sub>14</sub>-arylene, C<sub>4</sub>-C<sub>18</sub>-alkylene and/or C<sub>5</sub>-C<sub>8</sub>-cycloalkylene, and/or oligomeric polyesters or polyethers having terminal isocyanate groups and molar masses of from 200 to 5000,

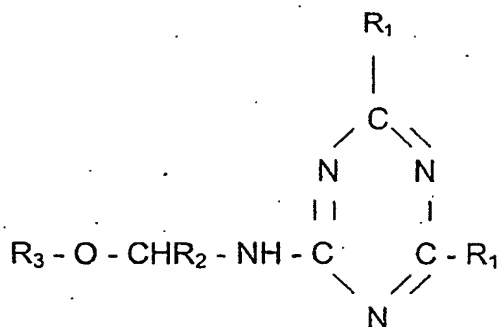
the molar ratio of diisocyanate to the sum of imino groups and amino groups in the triazine sequence being from 0.15 : 1 to 0.65 : 1, and it being possible for the mixtures to contain from 0.05 to 2% by mass, based on the aminotriazine ethers, of latent curing agents,

are melted at temperatures of from 85 to 130°C, reacted, and applied to textile substrate materials.

7. A process for the production of prepregs for fiber composites having high strength and resilience, characterized in that prepregs which comprise from 50 to 85% by mass of sheet-like textile structures and from 15 to 50% by mass of polyaminotriazine ethers containing carbamic ester groups are produced by a liquid application method in which

dispersions in C<sub>5</sub>-C<sub>12</sub>-hydrocarbons and/or C<sub>3</sub>-C<sub>12</sub>-ketones or solutions in dimethyl sulfoxide, dimethylformamide and/or dimethylacetamide having a solids content of from 25 to 70% by mass, comprising

A) aminotriazine ethers of the structure



$R_1 =$   $-NH_2$ ,  $-NH-CHR_2-OH$ ,  $-NH-CHR_2-O-R_3$ ,  
 $-NH-CHR_2-O-R_4-OH$ ,  $-CH_3$ ,  $-C_3H_7$ ,  $-C_6H_5$ ,  $-OH$ ,  
 phthalimido, succinimido-,  $-NH-CO-C_5-C_{18}-alkyl$ ,  
 $-NH-C_5-C_{18}-alkylene-OH$ ,  
 $-NH-CHR_2-O-C_5-C_{18}-alkylene-NH_2$ ,  
 $-NH-C_5-C_{18}-alkylene-NH_2$ ,

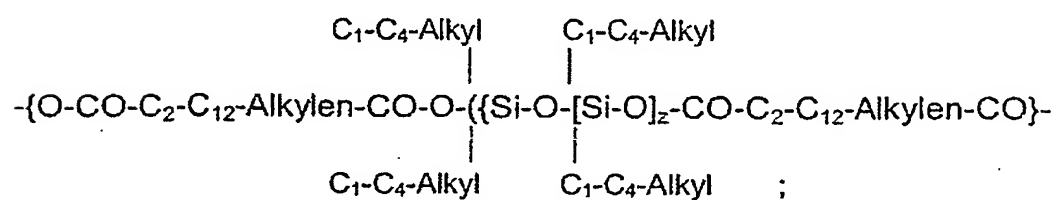
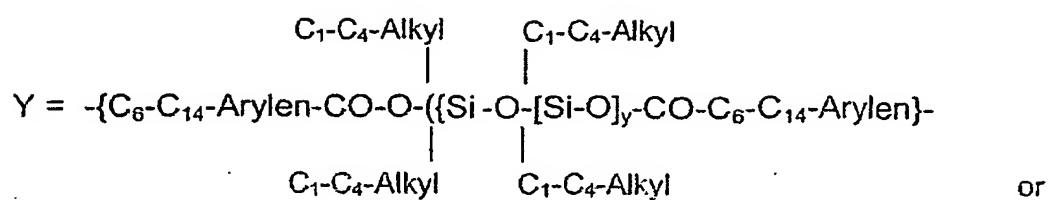
$R_2 = -H$ ,  $-C_1-C_7-alkyl$ ;

$R_3 = -C_1-C_{18}-alkyl$ ,  $-R_4-OH$ ,

$R_4 = -CH(CH_3)-CH_2-O-C_2-C_{12}-alkylene-O-CH_2-CH(CH_3)-$ ,  
 $-CH(CH_3)-CH_2-O-C_2-C_{12}-arylene-O-CH_2-CH(CH_3)-$ ,  
 $-[CH_2-CH_2-O-CH_2-CH_2]_n-$ ,  
 $-[CH_2-CH(CH_3)-O-CH_2-CH(CH_3)]_n-$ ,  
 $-[O-CH_2-CH_2-CH_2-CH_2]_n-$ ,  
 $-[(CH_2)_{2-8}-O-CO-C_6-C_{14}-arylene-CO-O-(CH_2)_{2-8}]_n-$ ,  
 $-[(CH_2)_{2-8}-O-CO-C_2-C_{12}-alkylene-CO-O-(CH_2)_{2-8}]_n-$ ,  
 where  $n = 1$  to  $200$ ;

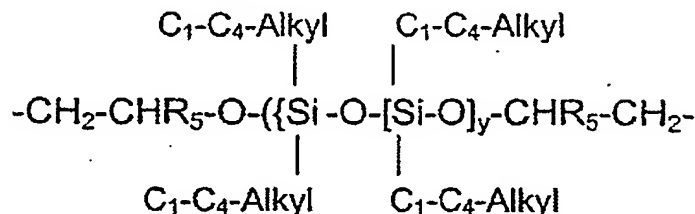
- polyester sequences containing siloxane groups  
 of the type  $-(X)_r-O-CO-(Y)_s-CO-O(X)_r-$ , in  
 which

$X = \{(CH_2)_{2-8}-O-CO-C_6-C_{14}-arylene-CO-O-(CH_2)_{2-8}\}-$  or  
 $\{(CH_2)_{2-8}-O-CO-C_2-C_{12}-alkylene-CO-O-(CH_2)_{2-8}\}-$ ;



$r = 1$  to  $70$ ;  $s = 1$  to  $70$  and  $y = 3$  to  $50$ ;

- polyether sequences containing siloxane groups and of the type



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where  $R_5 = \text{H}$ ;  $\text{C}_1\text{-C}_4\text{-alkyl}$  and  $y = 3$  to  $50$ ;

- sequences based on alkylene oxide adducts of melamine of the type comprising 2-amino-4,6-di-  
10  $\text{C}_2\text{-C}_4\text{-alkyleneamino-1,3,5-triazine}$  sequences;
- phenol ether sequences based on dihydric phenols and  $\text{C}_2\text{-C}_8\text{-diols}$  of the type comprising  
15  $\text{-C}_2\text{-C}_8\text{-alkylene-O-C}_6\text{-C}_{18}\text{-arylene-O-C}_2\text{-C}_8\text{-alkylene}$  sequences;

and/or

- B) mixtures of from 10 to 90% by mass of aminotriazine ethers A) and from 90 to 10% by mass  
20 of polyaminotriazine ethers having molar masses of from 300 to 5000, the polyaminotriazine ethers being formed by autocondensation of triazine ethers A),

and

25

- C) isocyanates of the formula  $R_6(\text{N}=\text{C}=\text{O})_2$ ,  
where  $R_6 = \text{C}_6\text{-C}_{14}\text{-arylene}$ ,  $\text{C}_4\text{-C}_{18}\text{-alkylene}$  and/or  $\text{C}_5\text{-C}_8\text{-cycloalkylene}$ , and/or oligomeric polyesters or  
polyethers having terminal isocyanate groups and  
30 molar masses of from 200 to 5000,

the molar ratio of diisocyanate to the sum of imino groups and amino groups in the triazine sequence being from  $0.15 : 1$  to  $0.65 : 1$ , and

it being possible for the mixtures to contain from 0.05 to 2% by mass, based on the aminotriazine ethers, of latent curing agents,

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are applied at temperatures from 5 to 80°C to textile substrate materials and reacted at from 80 to 120°C/from 0.1 to 1 bar and dried.

- 10 8. The process for the production of preregs as claimed in claim 6 or 7, characterized in that the aminotriazine ether used is 2,4,6-tris(methoxymethylamino)-1,3,5-triazine.

9. The process for the production of preregs as claimed in at least one of claims 6 to 8, characterized in that the latent curing agents used are weak acids, preferably
- blocked sulfonic acids,
  - alkali metal salts or ammonium salts of phosphoric acid,
  - C<sub>1</sub>-C<sub>12</sub>-alkyl esters or C<sub>2</sub>-C<sub>8</sub>-hydroxyalkyl esters of aromatic C<sub>6</sub>-C<sub>14</sub>-carboxylic acids or inorganic acids,
  - salts of melamine or guanamines with aliphatic C<sub>1</sub>-C<sub>18</sub>-carboxylic acids,
  - anhydrides, monoesters or monoamides of C<sub>4</sub>-C<sub>20</sub>-dicarboxylic acids,
  - monoesters or monoamides of copolymers of ethylenically unsaturated C<sub>4</sub>-C<sub>20</sub>-dicarboxylic anhydrides and ethylenically unsaturated monomers of the type comprising C<sub>2</sub>-C<sub>20</sub>-olefins and/or C<sub>8</sub>-C<sub>20</sub>-vinylaromatics, and/or
  - salts of C<sub>1</sub>-C<sub>12</sub>-alkylamines or alkanolamines with aliphatic C<sub>1</sub>-C<sub>18</sub>-carboxylic acids, aromatic C<sub>6</sub>-C<sub>14</sub>-carboxylic acids or alkylaromatic carboxylic acids and inorganic acids of the hydrochloric acid, sulfuric acid or phosphoric acid type.
10. A fiber composite produced using preregs as claimed in one or more of claims 1 to 5.
11. The use of a fiber composite as claimed in claim 10 for heat protection clothing, fire protection blankets, electrical insulation papers, construction parts and vehicle fittings.